

position. The tail of the new main roll in the upper position is tucked under the "bar" part of the transfer bar. As the stub roll is used up, the transfer bar moves down under spring loading until the tail of the main roll is engaged between the feed roller and the nib roller. The carousel assembly is symmetrical about a horizontal axis. A locking bar is pulled out to unlock the carousel assembly and allow it to rotate about its axis, and is then released under its spring loading to again lock the carousel assembly in place.

[0046] A side view, Figure 1, of the dispenser 20 with the cover 22 in place shows an upper circular bulge 24, providing room for a full roll of paper towel, installed in the upper position of the carousel. The shape of the dispenser is such that the front cover tapers inwardly towards the bottom to provide a smaller dispenser volume at the bottom where there is a smaller stub roll of paper towel. The shape tends to minimize the overall size of the dispenser. Figure 2 shows a perspective view of the dispenser 20 with cover 22 in place and the circular (cylindrical) bulge 24, together with the sunrise-like setback 26 on the cover 22, which tends to visually guide a hand toward the pseudo-button 28, leading to activation of a proximity sensor (not shown). A light emitting diode (LED) 130 is located centrally to the pseudo-button 28. The LED 130 (Fig. 3) serves as an indication that the dispenser 20 is on, and dispensing towel. The LED 130 may be off while the dispenser is not dispensing. Alternatively, the LED 130 may be lit (on), and when the dispenser 20 is operating, the LED 130 might flash. The LED 130 might show green when the dispenser 20 is ready to dispense, and flashing green, or orange, when the dispenser 20 is operating to dispense. Any similar combination may be used. The least power consumption occurs when the LED 130 only lights during a dispensing duty cycle. The sunrise-like setback 26 (Fig. 2) allows a hand to come more closely to the proximity sensor (not shown).

[0047] Figure 3 shows the main elements of the carousel assembly 30. The carousel arms 32 have friction reducing rotating paper towel roll hubs 34, which are disposed into the holes of a paper towel roll (66, 68, Fig. 4A). The locking bar 36 serves to lock and to release the carousel for rotation about its axis 38. The locking bar 36 rides on one of the corresponding bars 40. The two corresponding bars 40 serve as support bars. Cross-members 42 serve as stiffeners for the carousel assembly 30, and also serve as paper guides for the paper to be drawn over and down to the feed

roller 50 and out the dispenser 20. These cross members are attached in a rigid fashion to the corresponding bars 40 and in this embodiment do not rotate.

[0048] The legs 46 of the transfer bar 44 do not rest against the friction reducing rotating paper towel roll hubs 34 when there is no stub roll 68 present but are disposed inward of the roll hubs 34. The bar part 88 of the transfer bar 44 will rest against a structure of the dispenser, for example, the top of modular electronics unit 132, when no stub roll 68 is present. The bar part 88 of the transfer bar 44 acts to bring the tail of a new main roll of paper towel 66 (Fig. 4A) down to the feed roller 50 which includes intermediate bosses 146 (Fig. 3) and shaft 144. The carousel assembly is disposed within the fixed casing 48. The cover is not shown.

[0049] Feed roller 50 serves to feed the paper towels 66, 68 (Fig. 4A) being dispensed onto the curved dispensing ribs 52. The curved dispensing ribs 52 are curved and have a low area of contact with the paper towel dispensed (not shown). If the dispenser 20 gets wet, the curved dispensing ribs 52 help in dispensing the paper towel to get dispensed by providing low friction and by holding the dispensing towel off of the wet surfaces it would otherwise contact.

[0050] The feed roller 50 is typically as wide as the paper roll, and includes drive rollers 142 and intermediate bosses 146 on the drive shaft 144. The working drive rollers or drive bosses 142 (Fig. 3) are typically an inch or less in width, with intermediate bosses 146 (Fig. 3) located between them. Intermediate bosses 146 are slightly less in diameter than the drive rollers or drive bosses 142, having a diameter 0.015 to 0.045 inches less than the drive rollers or drive bosses 142. In this embodiment, the diameter of the intermediate bosses 146 is 0.030 inches less than the drive roller 142. This configuration of drive rollers or drive bosses 142 and intermediate bosses 146 tends to prevent the dispensing paper towel from becoming wrinkled as it passes through the drive mechanism and reduces friction, requiring less power to operate the feed roller 50.

[0051] A control unit 54 operates a motor 56. Batteries 58 supply power to the motor 56. A motor 56 may be positioned next to the batteries 58. A light 60, for example, a light-emitting diode (LED), may be incorporated into a low battery warning such that the light 60 turns on when the battery voltage is lower than a predetermined level.

[0052] The cover 22 of the dispenser is preferably transparent so that the amount of the main roll used (see below) may be inspected, but also so that the

battery low light 60 may easily be seen. Otherwise an individual window on an opaque cover 22 would need to be provided to view the low battery light 60. Another approach might be to lead out the light by way of a fiber optic light pipe to a transparent window in the cover 22.

[0053] In a waterproof version of the dispenser, a thin piece of foam rubber rope is disposed within a u-shaped groove of the tongue-in-groove mating surfaces of the cover 22 and the casing 48. The dispensing shelf 62 is a modular component, which is removable from the dispenser 20. In the waterproof version of the dispenser 20, the dispensing shelf 62 with the molded turning ribs 52is removed. By removing the modular component, dispensing shelf 62, there is less likelihood of water being diverted into the dispenser 20 by the dispensing shelf 62, acting as a funnel or chute should a water hose or spray be directed at the dispenser 20, by the shelf and wetting the paper towel. The paper towel is dispensed straight downward. A most likely need for a waterproof version of the dispenser is where a dispenser is located in an area subject to being cleaned by being hosed down. The dispenser 20 has an on-off switch which goes to an off state when the cover 22 is pivoted downwardly. The actual switch is located on the lower face of the nodule 54 and is not shown.

[0054] In one embodiment, the user may actuate the dispensing of a paper towel by placing a hand in the dispenser's field of sensitivity. There can be adjustable delay lengths between activations of the sensor.

[0055] There is another aspect of the presence of water on or near the dispenser 20. A proximity sensor (not visible) is more fully discussed below, including the details of its operation. However, as can be appreciated, the sensor detects changes of capacitance such as are caused by the introduction of an object with a high dielectric constant relative to air, such as water, as well as a hand which is about 70% water. An on-off switch 140 is provided which may be turned off before hosing down and may be turned on manually, afterwards. The switch 140 may also work such that it turns itself back on after a period of time, automatically. The switch 140 may operate in both modes, according to mode(s) chosen by the user.

[0056] A separate "jog" off-on switch 64 is provided so that a maintenance person can thread the paper towel 66 by holding a spring loaded jog switch 64 which provides a temporary movement of the feed roller 50.